Percent error of the lab

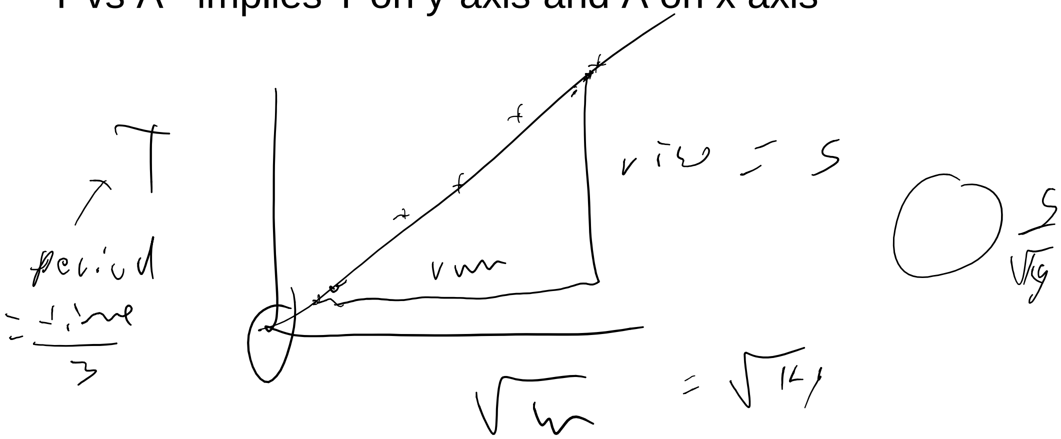
1- D kinematics review

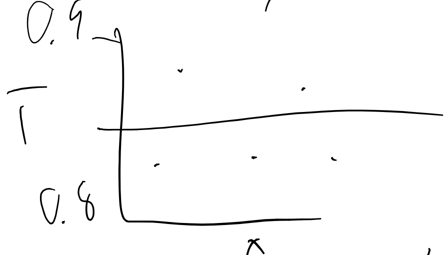
hand out textbooks and labbooks

hand back assignments

x - axis put the independent variable - the one you change eg. mass or Amplitude

T vs A implies T on y-axis and A on x axis





% error = $\frac{|exp - theo|}{theo} \times 100\%$

theoretical slope = $\frac{2\pi}{\sqrt{k}}$

k= (1.0 kg x 9.8N/kg)/0.25 m = 39.2 N/m

theo = 2 pi/root k
2 x 3.14159 / root(39.2 kgm/s^2 /m)
1.00 s/root kg

%error = |0.89 - 1.00s/ root kg| /1.00 s/root kg x 100%

11% error

Kinematics - describing motion

types of motion

constant velocity motion
velocity: rate of change in position
v= $\Delta x/\Delta t$ where x is your position vector
slope of a x - time graph
d is displacement, the change in position, Δx

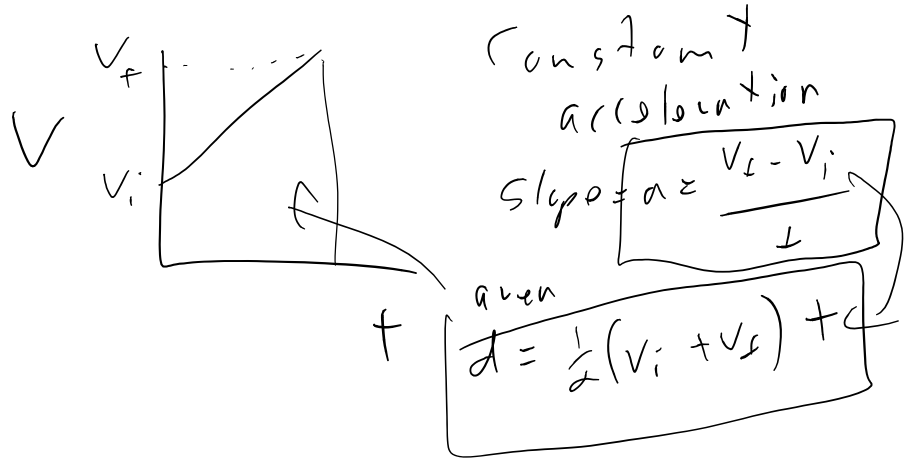
if velocity is constant, then
v=d/t   or d=vt
shape of the x-t graph is linear

constant acceleration, a
acceleration a= rate of change in velocity

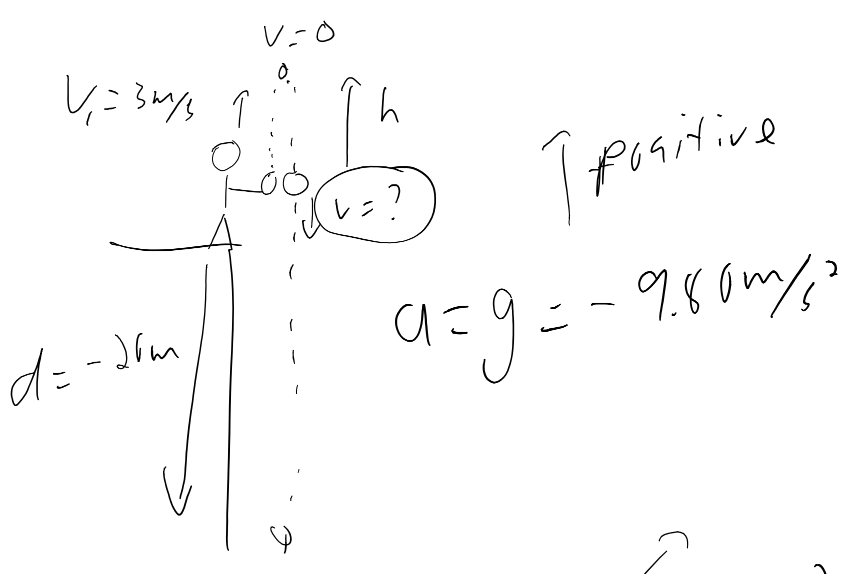
a=$\Delta v/\Delta t$
= slope of a v-t graph

if a is constant, then
$a = (vf-vi)/t$ or $vf = at + vi$

area under the v-t graph is displacement



$d = 1/2\, at^2 + vit$
$vf^2 = vi^2 + 2ad$
acceleration due to gravity = $9.80 m/s^2$ if air resistance is negligible - too small to matter
eg.
you throw a ball up at 3.0 m/s from the top of a 20.0 m high cliff.
a) how high does it go?
b) time to the top point?
c) velocity when it returns to the same height
d) acceleration i) going up ii) at the top iii) going down
e) time to hit the ground at the bottom of the cliff.
f) speed just before hitting the ground



$v \mid$ ·

a) $h = d$ $\quad v_f^2 = v_i^2 + 2ad$

$a = g$

$v_i = 3.0\,m/s$ $\quad d = \frac{-v_i^2}{2a} = \frac{-(3)^2}{2(-9.8)}$

$v_f = 0$

$d = 0.4592\,m$ unrounded *

$d = 0.46\,m$

b) $t = ?$

$a = g$

$v_i = 3.0\,m/s$ $\quad v_f = at + v_i$

$v_f = 0$ $\quad t = \frac{v_f - v_i}{a}$

$t = \frac{0 - 3.0\,m/s}{-9.80\,m/s^2}$

$t = 0.3061\,s$

$t = 0.31\,s$

c) Same but negative

$-3.0\,m/s$ by symmetry

$d = 0$ $\quad a = -9.8$ $\quad v_i = 3.0$

$v_f = ?$

$v_f^2 = v_i^2 + 2ad$

$V_f = -V_i$

d) all same, $-9.8\ m/s^2$

Percent error of the lab

1- D kinematics review

hand out textbooks and labbooks

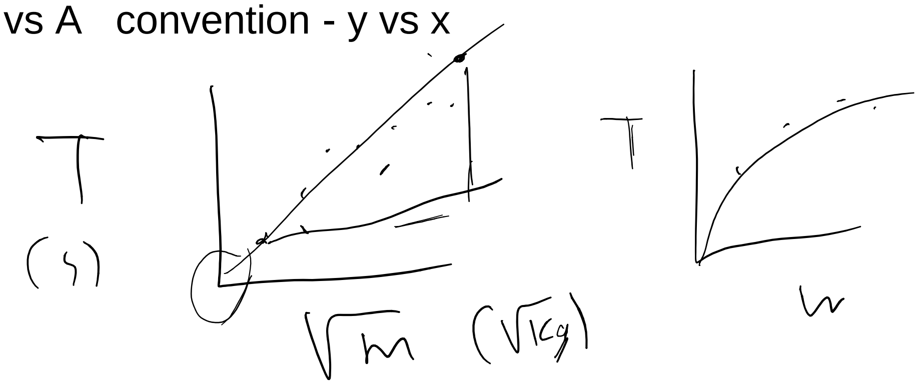
convention

x - axis - independent variable - the one you set

lab: part 1 mass part 2 amplitude

y - axis - dependent variable - the one you observed as you change the independent.

T vs A   convention - y vs x



$$T = \frac{2\pi}{\sqrt{k}}\sqrt{m}$$

Slope = $\frac{2\pi}{\sqrt{k}}$ — slope of graph

$$\%\ error = \frac{|theo - exp.|}{theo}$$

$1.0\,kg \times 9.8\,N/kg$ — $N = kg\,m/s^2$

[illegible] = [illegible]

$$\frac{\quad}{0.25\ m} = \ldots\ N/m$$

$$= 39\ \frac{kg}{s^2}$$

$$T_{theor} = \frac{2\pi}{\sqrt{39\ \frac{kg}{s^2}}} = \boxed{1.0\ \frac{s}{\sqrt{kg}}}$$

$$slope = 0.89\ \frac{s}{\sqrt{kg}}$$

$$\%\ error = \frac{\left(1.0\ s/\sqrt{kg} - 0.89\ s/\sqrt{kg}\right)}{1.0\ s/\sqrt{kg}} \times 100\%$$

$$= \boxed{11\%}$$

Kinematics - describing motion

types of motion:
constant velocity motion

- velocity rate of change in position with respect to time

$v=\Delta x/\Delta t$
x is position
Δ is change

if velocity is constant:
no acceleration
$v=d/t$ or $d=vt$
d is displacement = Δx in time, t

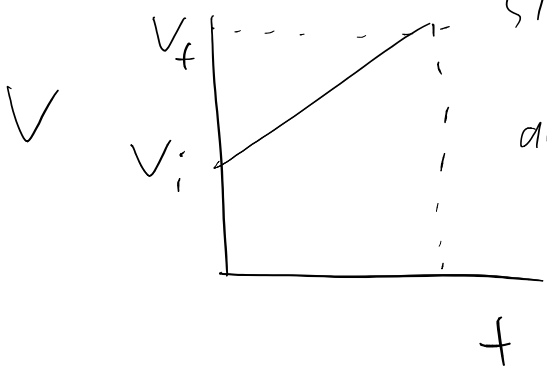
graph of x-t or d-t will be linear with slope = v

if acceleration is constant,
acceleration is rate of change in velocity
$a=\Delta v/\Delta t$
if a is constant then the v-t graph is linear
with slope = a
$a=(vf-vi)/t$ or $vf = vi + at$

area under a v-t graph (the integral) =
displacement

$slope = \frac{v_f - v_i}{t} = a$

$area = d = \frac{1}{2}(v_i + v_f)t$



by subbing the equations into each other you get:
$vf^2=vi^2+2ad$

$d=1/2at^2 + vit$

if acceleration is not constant, don't use these equations, use energy conservation or work or calculus (jerk is the rate of change in a)

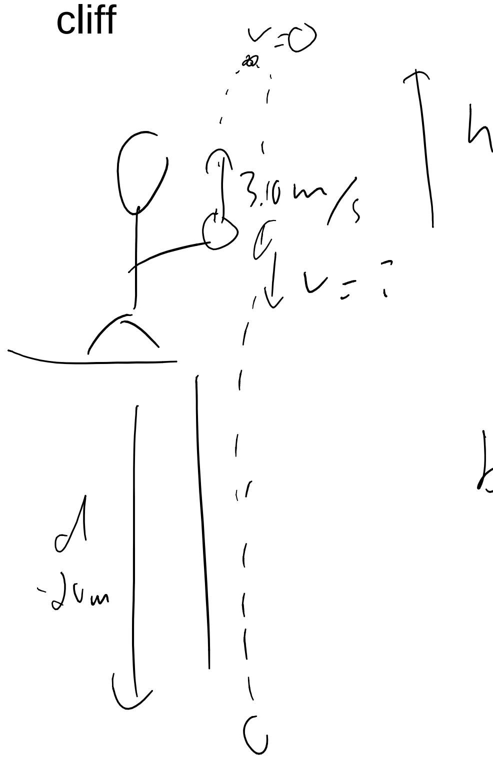
objects in freefall accelerate at 9.80 m/s^2 down if near Earth and negligible air resistance

eg. you throw a rock up at 3.0 m/s from the top of a 20.0m high cliff.

a) what is the acceleration of the rock
 i) going up ii) at the top iii) going down
b) maximum height
c) time to maximum height
d) velocity when the rock returns to the same point you threw it from
e) time to hit the bottom of the cliff
f) velocity just before hitting the bottom of the cliff

$v=0$

f) velocity just before hitting the bottom of the cliff



a) $-9.80\ m/s^2$

$a \parallel$ to motion

↑ up is positive

b) $d = h = ?$

$v_i = 3.0\ m/s$

$v_f = 0$

$a = -9.80\ m/s^2$

$$v_f^2 = v_i^2 + 2ad$$

$$d = \frac{-v_i^2}{2a} = \frac{-(3.0\ m/s)^2}{2(-9.80\ m/s^2)}$$

$d = 0.4592\ m$

$d = 0.46\ m$

above where you threw

c) $t = ?$

$v_i = 3.0\ m/s$

$v_f = 0$

$a = -9.8\ m/s^2$

$$v_f = v_i + at$$

$$t = \frac{v_f - v_i}{a}$$

$a = -9.8\ m/s^2$

$= \frac{0 - 3.0\ m/s}{-9.8\ m/s^2}$

$= 0.3061\ s$

$= 0.31\ s$

d)

$v = -3.0\ m/s$ by symmetry